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THE LAWS  
OF  
EPIDEMIC AND CONTAGIOUS  
DISEASES:

AND THE  
IMPORTANCE OF PREVENTIVE MEDICINE:

An Introductory Address

TO

THE EPIDEMIOLOGICAL SOCIETY,  
DELIVERED AT THE COMMENCEMENT OF THE FOURTH SESSION,  
NOVEMBER 7, 1853.

BY

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Published at the Society's request.

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London :

JOHN CHURCHILL, PRINCES STREET, SOHO.

1854.





## INTRODUCTORY ADDRESS.

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It is to no particular fitness in myself, but to the too friendly expectation of your learned and respected President, that I am indebted for the honour of addressing you, on the occasion of inaugurating this, the fourth session of the Epidemiological Society. It is to him, intimating a desire, to be for a season relieved from the onerous and oft discharged duty of opening our annual Session, that I owe the privilege of supplying a place, which may, I fear, be most inadequately filled. Connected as I have been with Dr. Babington, from the time when our first measures were taken for the formation of this Society, and viewing him as we all do in the light of a much esteemed and valued friend, who exercises his official calling, not for personal benefit, but for the public good, I have pleasure in complying with his wish to be now relieved from the labour of this our annual address.

Fully appreciating the extent and importance of *preventive medicine*, as the mistress rather than the handmaid of *curative science*, and looking back over a long period of service in India, where it has been

often brought to bear on the welfare of military masses and prisoners in jail, I have not unwillingly consented to address you, on the surpassing utility of those scientific investigations, which are the objects of this Society's research. The historical origin of this association; its objects of investigating epidemic and contagious diseases, to an extent commensurate with exertions in other departments of medical science; and the application of the principles of *preventive medicine*, to practically ameliorate human misery, and secure the well being of society, have been so fully and earnestly stated by the council, and in the President's former addresses, that I could add nothing to the force of such appeals.

Happily anticipated in this general work of labour and of love to the Society, I am yet permitted to turn to some special subjects of not less utility and interest; and, at the very threshold of an expected outbreak of destructive cholera, would direct your attention to what is known regarding "*the laws of epidemic and contagious diseases.*" I would not forget what others have thought and written concerning them; in order that we may not incur the reproof, which Hecker gives to other epidemic investigators, that, through ignorance of analogous phenomena, and the materials of past ages, the experience of many centuries had been accumulated in vain. I am deeply sensible of the magnitude of this field for study on which I enter, as well as my probable shortcomings, in attempting to dispel the darkness that overshadows it; but should success fall short of your expectations, permit me to say that failure proceeds only from want of ability, not from any lack of anxious desire to surmount the difficulty of the task.

Any details of facts and observations, relative to the question before you, and on which the analytical conclusions are based, except such as may be necessary in illustration and proof of the deductions, would be beyond the limits of this address. I must simply, on this occasion, and for the more ready condensation and comprehension of the opinions I have formed, proceed by the *synthetic* method. In commenting on the facts and evidence of many trustworthy witnesses, who may have sometimes drawn opposite conclusions from them, I shall endeavour to view them with juridical impartiality, and with no preconceived bias of opinion.

The phenomena of artificial diseases induced by a *specific virus*, or *materies morbi*, introduced into the organism, in so far as they are analogous to the phenomena of *natural diseases*, shed much light on the nature and origin of the latter. These owe their development to no simple or uniform act of a definite poison; but to certain atmospheric, telluric, and alimentary morbid agents, which act in combination to prevent normal elimination from the body, of disintegrating organic compounds, the residue of its own nutritive processes; or which introduce from without certain septic principles which act as ferments. The essential elements of this opinion have been often expressed by me at the meetings of this Society, and were, now some years since, enunciated in what I wrote regarding the origin of the *rheumatic diathesis*, that it is the result of pre-existing lesion of the assimilating functions of the body; which, on the application of cold, errors of diet, intoxication, malaria, and like exciting causes, gives rise to that abnormal change of blood which constitutes such



diathesis.\* Dr. Laycock, previously reviewing Dr. Ormerod's work on continued fever, had said, that the best point of departure for investigating fevers in general, is the fact that they all depend primarily on poisoning of the blood. Dr. Carpenter has since afforded definite physiological proof of the abnormal uniform condition of the blood in such cases, being the invariable antecedent of the morbid action of epidemic exciting agents.

In a late very able review of the predisposing cause of epidemics, published in the last January number of the "*Medico-Chirurgical Review*", Dr. Carpenter has entered into a luminous exposition of the *modus operandi*, in the blood of individuals, of those combined predisposing causes, which produce susceptibility of the living body to the morbid impression of additional febrile or specific poisons; acting as exciting agents to call into activity the phenomena of special epidemic or contagious diseases. The assumption that the exciting cause of all febrile diseases is a special poisonous agent of the *zymotic class*, plus the predisposed general condition of communities or individuals, asks more perhaps than can be granted in all cases, where the hurtful exciting agent cannot be proved to be a specific poisonous matter. The soundness of the argument, however, is drawn from the supposed predisposing action of special miasmatic and septo-febrile causes being analogous to the established action of definite *specific poisons*. Where the predisposing causes mentioned have been allowed full time for producing on the blood, and the nutrition, their general disintegrating

\* Rankin's Half-yearly Abstract of the Medical Sciences, Jan. to June 1851.

effects, it may be well doubted whether any additional exciting agent beyond exposure to cold and moisture, with certain atmospheric alternations, be requisite for the production of many epidemic febrile diseases. And at best, the opinion of the exciting cause in such cases being a special poison, rests almost entirely on assumption. But in conducting an enquiry into the origin of either epidemic or contagious diseases, or the laws to which they are subject, we may trace the chain of analogy in the action of medicinal, contagious, and septo-miasmatic poisons, and may derive important aid for our argument by reasoning from what is known to what is unknown.

To embrace the whole scope of such an enquiry, reference should be made to the manner in which poisons generally are introduced into the organism and modify its functions; the mode in which their specific effects are produced; and the manner in which the living body can by its own unassisted efforts, or the aid of pure air, wholesome food, cleanliness and sufficient clothing, free itself from poisonous agents, and become restored to the equilibrium of health. The subject thus naturally divides itself into:—1st. The laws under which epidemic and contagious diseases take their origin, and are diffused: 2nd. The application of a knowledge of these laws to prevent predisposition to such maladies, mitigate their severity, and limit their diffusion. These two branches of necessary study, both for the profession and the people, may be said to constitute the *principles* and *practice* of *preventive medicine*; and have, in all respects, an intimate relation to a philosophical and comprehensive understanding of *curative science*. It is at once the privilege and the duty of our own

humane and scientific profession, to make such knowledge more available for the intellectual masses of the population: and the more widely such can be diffused among them, they will better learn how to avoid the meddlesome interference, with disease, of the bold and fearless *empiric*; and cease to trust, where nature's resources must fail, to the do-nothing practice of the deluded *homœopathist*.

No department of medicine has of late years been more assiduously cultivated by the profession, or occupied a larger share of public attention, than that which embraces the origin and spread of epidemic diseases. But while a large collection of facts has been made, and some general principles evolved, to serve as the basis of a practical code of preventive medicine; a wider and better recorded series of observations, on the development and progress of these diseases, to serve for the establishment of a more comprehensive system of general principles, with better and more definite rules of art, are still *desiderata*, in this most important branch of our profession.

In entering on the investigation we must not allow ourselves to be led astray by the idea, that all the facts we are in search of should be novel, or altogether unobserved and unknown to those who have gone before us. Even the wonder exciting cholera, which, becoming a subject of popular interest, is dated as a new disease from the reputed epoch of its birth in India, 1817, was long previously known to practical observers. From the delineations of this disease found in Dr. Morton's "Treatise on Fevers", Dr. Chambers has, with great ability, proved that a disease, identical with the Asiatic malady, prevailed in London about A.D. 1680, and had a common origin with



other epidemic febrile diseases. Some of the earlier writers too, on the diseases of India, as Paisley, Girdlestone and Curtis, recorded the prevalence of this disease, long antecedent to the year 1817. In 1695 it broke out with great severity among the soldiers of Aurangzebe's army, while besieging Bejapoor. The Persian author, who records the circumstance, states, "that amidst the calamities of a famine, which afflicted the country the previous year, pestilential fever and diarrhœa attacked the people in camp; and by little and little spread through the whole with such fatality, that no one reckoned on his existence for a single hour, so that the bazaar transactions were carried on only for ready money." Overlooking facts which have long since been before the world, we cannot expect success from any endeavour to improve preventive medical science, that would slightly ignore the accumulated observations of ages, or by holding the belief that before we entered on the enquiry all was blank.

By more careful scrutiny of doubtful points of observation, by varied and better devised methods of experiment and analysis, for discerning intellectually what can only be obscurely revealed to the senses, and above all by a more comprehensive and luminous classification of fixed data so obtained, we will be able to trace, with more precision, the laws by which morbid causes act on the organism, and give origin to both epidemic and contagious diseases. It would be a vain attempt, should I endeavour to point out all the works of many venerable names, to which useful reference may be made on this subject. I may content myself by briefly enumerating a few of those more generally known, as the productions of men

who flourished either in the past or present century ; and which may be read and studied by all of us with advantage. These are the works of Sydenham, Huxham, Cleghorn, Van Swieten, Clarke, Lind, and Pringle ; and in more modern times Sir Henry Holland's "*Medical Notes and Reflections.*" Also the Sydenham's Society's edition of *Hecker on Epidemics*, translated by Dr. Babington ; Dr. Henry's report on the state of our knowledge of the laws of contagion ; Dr. Davidson's prize essay on the sources and mode of propagation of the continued fevers of Great Britain and Ireland ; Dr. Mc. Williams' report on the fever of Boa Vista, with the correspondence on the subject of the "Eclair," and the epidemic which broke out in the said vessel, presented to the House of Commons, 1846 ; Dr. Robert Williamson on morbid poisons in his *Elements of Medicine* ; Southern America Medical Reports, edited by Dr. Fenner, of New Orleans ; the Report of the French Academy Commission on Plague and Quarantine ; the correspondence respecting the Quarantine Laws, presented by command to the House of Commons ; and the Registrar General's Report on Cholera.

To proceed with the main subject of this address, let me enquire what are the characters of epidemic and contagious diseases ? *Epidemic diseases* are those which attack many persons within a given time ; which generally return and cease in the same season, after being frequently preceded by other affections, more or less akin to them. During the prevalence of epidemic disease, other special diseases become less numerous, and take on the characters of the dominant affection ; while individuals of a community who continue in good health, but are ex-

posed more or less to the compound poisonous agents which produce epidemics, experience modified effects of the general influence.

*Contagious diseases*, again, taking the meaning of the term in its widest sense, are those which are propagated from one individual to another, by the generation of a subtle excreted matter, capable of exciting like affections in others. They have been divided into those which are communicable from one person to another, by direct contact, or the transference by inoculation of a visible morbid poison; and into those which, though communicable by inoculation or contact, are also transmissible through the medium of the atmosphere. In the former division, may be classified vaccina, syphilis, gonorrhœa, and Egyptian ophthalmia; in the latter, variola, rubeola, pestis, scarlatina, pertussis, influenza, puerperal fever, typhus, hospital or jail fever, with perhaps both yellow fever and Asiatic cholera.

It has been proposed by some medical observers, that the appellation contagious should be limited to diseases capable of multiplying themselves, apart from any accessory circumstances of predisposed states of individual recipients, aided by certain local and general atmospheric conditions. But there are facts sufficient to show that all of these are sometimes requisite to develop the results of both febrific and specific poisonous agents. Sir Henry Holland, in his philosophical chapter on contagion, has justly remarked, that the very view of regarding infection as a simple and uniform act must carry error into every part of the discussion: and the hypothetical assumption, that specific poisons require no accessory help of individual predisposition, or atmospheric conditions,

for their development or propagation, has greatly contributed to involve the subject of secondary febrile and specific poisons in mystery and contradiction. The words contagious and infectious may therefore be taken as synonymous: as the poisonous agents, which in both classes of disease produce their effects in the animal economy, approximate so closely to each other in their physiological action, that reasonable doubts may be entertained of their absolute dissimilarity. Under certain occult atmospheric conditions, local and general, the virus of small pox and plague acquire unusual power of development, and virulence of propagation: but in the absence of such conditions, or less favourable atmospheric states, the former cannot be inoculated, nor the latter become contagious. During the prevalence of the Harmattan, on the African coast, small pox ceases to be contagious, as noticed by Dr. Copland, and recorded by Mr. Norris. The sporadic plague of Egypt, which appears there annually, and the Pali plague of India, may be regarded as non-contagious diseases, from the absence of the necessary conditions of contagious development and propagation. The virus of cow-pox too, in particular climates, and at certain seasons, in India, cease to be active or convey immunity from small pox; and yellow fever, in relation to a lower temperature than  $79^{\circ}$ , loses its malignity and is annihilated. Dr. Barton, in his essay on the meteorology and vital statistics of Louisiana, observes, that in a series of years, from 1793 to 1817, embracing many outbreaks of yellow fever, it occurred in *no year*, when the average of the thermometer, at three o'clock, was under  $79^{\circ}$  during the summer, and that the extent and malignancy of the disease was proportioned to



the extent in which it exceeded that height. If then a specific virus, such as small pox, or cow pox, can be so modified by climate and season, as to become inert for the want of certain conditions, numerous observations on the *non-contagious character* of *sporadic plague*, and that both typhus and yellow fevers respectively, when contagious, can be destroyed by very hot, or very cold weather, leads inevitably to the conclusion, that the contagion of any disease is merely contingent on conditions of existence. It is not invariable without them, whether that disease be manifested as the result of combined febrile or specific poisonous agents; and argues strongly against the too easily received belief of the sempiternal existence and unmodified quality of certain specific poisons. Dr. Henry, while supporting the doctrine of the non-spontaneous origin of specific contagions, admits that in the Milbank Penitentiary, a prisoner was seized with small pox notwithstanding his apparent insulation; and with reference to *scarlatina*, *hooping-cough*, and *measles*, they appear, during particular seasons of the year, so simultaneously in certain localities, as to exclude the probability of specific contagious propagation being the cause of their appearance. Epidemics may thus present themselves of a *non-contagious* or *contagious character*; the contingent character of contagion being developed at a certain stage of febrile diseases, which may have primarily had their origin from septo-miasmatic poisons. Cleg-horn, Clarke, and Fordyce, maintain the affirmative of the question, even in respect of intermittents under certain conditions: but, whenever such fevers, or their analogue, epidemic dysentery, have assumed the contagious character, they have done so by having



the impression of a fresh poison of the *ochletic*\* class superadded to the phenomena of their original development. The accidental union of certain circumstances may develop a poisonous agent capable of multiplying itself, should it only meet with pre-disposed subjects under the requisite conditions of climate and season; without which it necessarily becomes inert. Such, apparently, is the case with plague and yellow fever; the contagious germs of which, when produced, may again become extinct under certain conditions of temperature and climate. The epidemic yellow fever of 1793, which prevailed in Philadelphia, was checked suddenly by rain and cold weather; and that of Gibraltar, in 1810, was arrested by a cold north wind. The plague of Egypt also ceases to commit its ravages after St. John's day, that is when the heat and dryness of the atmosphere, or some other yet undiscovered condition are incompatible with the spread of the disease. In regard to cholera, further and more accurate observations are necessary, before any affirmative opinion can be given, that it sometimes generates a definite and uniform poisonous principle, capable of multiplying itself in its passage through other human bodies, like the definite *zymotic poisons* of plague, small pox, scarlet fever, or contagious typhus. If such secondary reproduction sometimes occurs in cholera, and which may, I have reason to think, occasionally happen, the case is exceptional. It takes place only under conditions of over-crowding human beings into ill-ventilated apartments, with deficient

\* This, which is a very expressive term for diseases produced by overcrowding many persons together, was first made use of by Dr. Gregory.

breathing space ; of putrid excrete exhalations from many human bodies, accompanied by local and general humid states of the atmosphere ; and above all, those morbid conditions of the blood, produced by disintegrating causes of poverty, famine, or food and water of bad quality, containing septic principles. It is probable, that the disease, where it engenders *ochletic* miasms, can be thus reproduced by pulmonary imbibition of such morbid agents, just as influenza or hooping cough.

But to proceed further than the merely conditional characters of epidemic and contagious diseases, let us enquire under what laws do they originate, are propagated and decline ; and whether we can obtain a scientific expression of the nature of the phenomena and facts regarding them, which may be applicable as *sanitary rules of practice* in preventive medicine. Health, comparatively in individuals, is maintained by the greater or less fitness of the human organism, to keep intact the vital affinity necessary for sustaining the nutritive, secretory, excretory, and nervous functions, in a state of harmonious activity in relation to each other ; and in the condition of comparative exemption from the morbid results of those physical agencies, which are subversive of complete integrity in the vital and organic functions. Though facts then, established by Parent-Duchatelet and others, would show that many persons may live constantly amidst concentrated putrid animal emanations, and be less subject to some epidemic diseases than the inhabitants in their neighbourhood ; yet the natural deduction from them can only be that the human organism, in certain some most unsanitary conditions, possesses reparative power in itself to

eliminate, by the excretory organs, certain hurtful poisonous agents, so as to preserve the standard of health. Such, however, may be taken as the exceptions, and the converse of the proposition looked upon as the rule; as more extensive and better recorded observations prove, that under certain predisposed states of the system, when normal elimination is suspended, such septic emanations are not only the sources of continued fevers, but the means of favouring their diffusion. Such predisposed states of individuals or communities are, as Dr. Carpenter correctly terms them, cases of *retrograde metamorphosis*, from recognised predisposing causes, producing in the blood an undue accumulation of azotized matter. If the blood be not furnished then with proper alimentary materials for the tissues, the inspired oxygen of respiration, acting on such, converts them into abnormal products of nutrition, accompanied by a corresponding waste of tissues. The elimination of these, through the excretory organs, being still further suspended by putrid excrete exhalations, humid atmosphere, either general or local, insufficient breathing space, and defective ventilation, fevers of a severe and even contagious type become thus developed.

The growth and health of the body being dependent on the conversion of dead organic matter into the substance of the living organism, through the agency of oxygen, the effete unoxylized residuary materials of nutrition, when not eliminated by normally performed functions of the skin, liver, and kidneys, must necessarily disturb the equilibrium of health, and produce febrile disease. The principal functions may be thus reduced to chylication, sanguification, excretion, and innervation. For the maintenance of

the two former, wholesome food and drink, pure air and a normal condition of the nervous system, and of the organs concerned in *primary assimilation*, are requisite; for the latter, the due performance of *secondary assimilation* and excretion is necessary. Whatever additional causes may further disturb the nutritive processes, such as intemperance or fatigue, contribute much to the origin and spread of epidemics.

In as far as we are now able to trace the nature of simple epidemic diseases, or ascertain the relations of the phenomena and facts concerning them, we may admit the following general law of their origin: FIRST, *that certain intrinsic and extrinsic epidemic agents, which suspend normal elimination of excrete materials from the blood, are also disassimilating organic poisons, which give rise to certain excretive febrile phenomena.* Though there be yet no definite proof that the intrinsic predisposing, and extrinsic exciting causes of epidemic febrile diseases are direct febrific poisons, acting by fermentation on the blood, I here assume it as a thing generally admitted by the best authorities, and one likely to be yet demonstrated by well devised chemical and physical experiments. Although the living organism appears so well protected against those analogous destructive processes which are extrinsic to it, it is, nevertheless, known to be composed of immediate chemical elements, which take on those indirect *catalytic* decompositions, that produce grape sugar in diabetes, uric acid in gout, and lactic acid in rheumatism. Sometimes, again, the same elements are susceptible of the true fermentative and putriferous processes, from which order of molecular decompositions, effected under the influence of suspended normal elimination, and certain extrinsic



causes acting in combination, other excrete secondary poisons are produced. Some very philosophical and suggestive remarks, in the review of Dr. Ormerod's work on fever,\* which were, as I now learn from Dr. Carpenter, written by Dr. Laycock, suggested to my mind the following tabulated arrangement of both febrile and specific poisons, as well as of the diseases they produce.

## I. CLASSIFICATION OF POISONOUS MORBIFIC AGENTS.

### I. INDEFINITE ZYMOTIC POISONS.

1. Paludal Emanations, or Malaria.
2. Excrementitious Septo-miasmata.
3. Excrete Oehletic miasms.

### II. DEFINITE ZYMOTIC POISONS.

#### I. *Exanthematous Poisons.*

1. Variola.
2. Rubeola.
3. Scarlatina.
4. Contagious Typhus.
5. Erysipelas.
6. Syphilis, and others.

#### II. *Epezzootic Poisons.*

1. Hydrophobia.
2. Vaccina.
3. Glanders.

## II. CLASSIFICATION OF FEBRILE ZYMOTIC DISEASES.

### I. MALARIOUS FEVERS.

1. Intermittent.
2. Remittent.

### II. EXCRETIVE EXANTHEMATA.

1. Variola, or Small-pox.
2. Rubeola, or Measles.
3. Pestis, or Plague.
4. Scarlatina, or Scarlet Fever.
5. Genuine, or Contagious Typhus.
6. Varicella, or Chicken-pox.

\* See *British and Foreign Medical Chirurgical Review*, January 1849.



## III. EXCRETIVE BRONCHO-LARYNGEAL DISEASES.

1. Influenza.
2. Pertussis, or Hooping-cough.

## IV. EXCRETIVE GASTRO-ENTERIC FEVERS.

1. Yellow Fever.
2. Puerperal Fever.
3. Asiatic Cholera.

## V. OCHLETIC FEVERS.

Jail and Hospital Fevers.

We yet want records of observation and experiment to teach us whether the retained excrete elements of suspended elimination in the system, by acting catalytically on the blood, can produce new combinations that give rise to predisposition or individual susceptibility. This, however, favours the action of those additional febrific poisons, which bring on results in the economy, known under the general denomination of fever, and vary as much in the phenomena of their manifestation as do the pathological conditions of races, communities, or classes of men. When such fevers, however, give rise to excrete secondary or specific poisons, the *catalytic*, or fermentative action in the blood of the individual generally exhausts his constitutional susceptibility for a second attack, by changing that pabulous fermentative blood matter, without which, neither the specific fever which followed nor the poison eliminated could have been produced. In Caius's tract on the epidemic sweating sickness of England, reprinted by Dr. Babington in *Hecker's Epidemics*, the same pathological idea is thus very accurately expressed. "For as hereafter", says he, "I will shew, and Galen confirmeth, our bodies

cannot suffer anything or hurt by corrupt and infectious causes, except there be in them a certain matter, prepared, apt, and like to receive it; else if one were sick, all should be sick; if in this country, in all countries where the infection came, which thing we see doth not chance." Hence such epidemic fevers, by giving origin to multiplying specific contagions, are known under the name of non-recurrent. Much of the acrimonious controversies and contradictory evidence which are met with recorded on the subject of plague and yellow fever, may be traced to the fact, that observers overlook the varying predisposed conditions of individuals who may have been submitted at different times to the influences of one or more febrific poisons on the system. On the subject of yellow fever in the "Eclair", those who deny that marsh yellow fever may assume contagious properties, are driven to maintain the highly improbable opinion that two distinct diseases, under like conditions, were prevalent at the same time. But to here analyze the evidence on which such opinion is founded would much exceed the limits of this address. Nor am I now required, in proof and illustration of this law, to determine the exact nature of extrinsic epidemic agents, or whether such act as direct or indirect poisons. M. Fourcault, from his experiments on suspended cutaneous transpiration, calls in question the soundness of the opinion that admits the existence of a specific agent or unknown poison in the causation of intermittent fevers. Such fevers depend, he thinks, on the concurrent conditions of moisture of the air, elevation of temperature, and atmospheric vicissitudes. It would equally exceed my limits to follow the enquiry, how far the development of *ozone*, or the modified electrical condition of

oxygen in the atmosphere, may be regarded as one of these agents, or considered as the exciting cause of cholera and other epidemics. But whatever be the poison or poisons which give rise to varied forms of yellow fever, plague, typhus, and cholera, if we essay to attain a more definite knowledge of their nature, we must more carefully study them in relation to their geographical limits and latitudes, the varying susceptibilities of the inhabitants of different districts, and the modified chemical conditions of a specific virus, produced by extrinsic circumstances of soil, temperature, humidity, and occult atmospheric conditions.

The SECOND LAW of such epidemio-contagious diseases is—*That certain excretive febrile phenomena, particularly those of an exanthematous character, produce secondary poisons, capable of multiplying to a great extent like diseases; and that the quantity of poison sufficient for producing such diseases is determined, as in simple epidemics, by the predisposition, temperament, or constitution of individuals at the time.* In most cases of febrific poisoning there is, as Dr. Laycock well observes, a general poisonous influence manifested, with a specific determination to some special organ, from which is excreted a visible specific virus transferable by inoculation, or a gaseous poison capable of being multiplied in others by pulmonary or cutaneous imbibition. In the case of excretive exanthematous diseases, the proof of a certain specific agent is less difficult of determination than in other classes of disease where it is not visible to the senses, and may be either annihilated in the system, or generated under certain unsanitary favouring conditions. It is now a very general opinion, however, and one founded on long experience and observation, even from the

time of Hippocrates, that continued fever, produced by a modification of those causes which give rise to remittent fever, may at a certain stage of its progress manifest contagious characters, and give rise to other fevers contagious from the commencement. The general fact ascertained by Andral, in his pathology of the blood, that during the progress of all such fevers the fibrine of the blood invariably decreases, establishes the special nature of *fevers* from *inflammations*, in which the very opposite condition is exhibited. The relative proportion too of the blood globules, though diminished in fevers as well as the fibrine, was found comparatively less so in these than in the latter.

In regard to the generally non-recurrent character of specific febrile diseases, the THIRD LAW appears to be—*That definite secondary poisons, by exhausting the pabulous fermentative matter necessary for their production, generally extinguish the susceptibility of the constitution for a fresh attack and prevent their recurrence.* From our now comparative ignorance of the real nature of these indefinite morbidic agents, presumed to be poisonous, we can only reason by analogy from what is known of specific and medicinal poisons, to what we would know of the effects produced on the system by indefinite poisonous agents. One thing we have endeavoured to render evident, that a peculiar predisposed condition of blood must exist before the exciting agent can act. This predisposition, in the instances of measles, hooping-cough, scarlatina, and perhaps yellow fever, seems to be greater or less at various ages, and in time becomes obliterated. Dr. Carpenter ascribes this predisposition “*to an accumulation of disintegrating azotized compounds, in a state of*



*change, in the circulating current*"; and if true and demonstrable, the immunity from future recurrence, which persons once subjected to the action of the virus enjoy, must depend on the subsequent absence of like constitutional blood conditions. In the case of secondary attacks of small-pox such requisite blood conditions return. These must also be reproduced at various ages, and under changes from one climate to another; circumstances under which the specific matter of cow-pox fails in producing constitutional protection against those modified forms of small-pox known as varicella or chicken-pox. This law, however, is all but universal in relation to the non-recurrent diseases of infancy and youth; and future exposure to a like poisonous virus is followed by no return of these diseases.

The FOURTH LAW, both of indefinite and definite morbid poisons, is—*That they are more or less active in proportion to the constitutional susceptibility of individuals, while climate and season modify their intensity and influence the specific action of the latter.* In regard to plague and yellow fever, as well as other epidemic and contagious diseases, the susceptibility of the population of districts, of races, and communities of trade employment, has been too much overlooked. Thus the negro is almost exempt from the destructive fevers to which the white race on the western coast of Africa are so liable, but is nevertheless peculiarly susceptible of the plague which devastates its north-eastern coasts. Regarding the sweating sickness, which prevailed in England five times from the first year of Henry VII to the fifth year of Edward VI, or from August A.D. 1485 to 1551, we are told by Caius that it never



entered Scotland, except on the borders ; and though often prevalent in Brabant and the neighbouring coasts, had never but once passed into Germany, where it was in like fashion as in England. As a general rule, then, great numbers of the population, after a widely-spread epidemic, (particularly yellow fever), are protected against second attacks ; and a fresh generation of unprotected victims, or susceptible individuals, must spring up before another epidemic outbreak takes place. With regard to cholera, however, as far as we can yet learn, it can be scarcely said to hold good, as second attacks have been known to not unfrequently occur ; but in relation to small-pox, scarlatina, measles, and hooping-cough, the law is all but universal. Regarding the influence of climate and season on the specific virus of small-pox and cow-pox, examples have been already quoted, and it is scarcely necessary to repeat that yellow fever is annihilated by much cold, as contagious typhus fever is by great heat. Typhoid fever, which is often engrafted on other diseases, and is merely a group of adynamic symptoms, is frequently met with in tropical climates, while eruptive or *genuine typhus* is never seen there.

Such is a brief, though confessedly imperfect, analysis of the nature and relations of the phenomena which present themselves in the development and progress of both epidemic and contagious diseases ; and while still capable of being reduced to more perfect generalization, or the laws to which they are subject, the present may now suffice for determining the limits within which nature bounds her deviations, though regulated by certain conditions according to

varied predisposition, differences of soil, locality, and climate. The utility of such scientific results must be estimated in proportion as they can be made the foundation of serviceable rules of conduct, and the art of preventive medicine.

But before proceeding to a few short observations on the practical bearing of the laws we have deduced, I would turn your attention for a moment to some of the theories which have been proposed to account for the origin and prevalence of epidemic disease. The first is the animalcular or infusorial theory of Dr. Henle, who, observing in organic mixtures that certain genera of infusoria, after appearing and existing for a time, at length vanished and made way for new ones, or that one genus could serve for the generation, or rather nourishment, of another,—came to the conclusion that a remarkable analogy existed between such and the phenomena of epidemic diseases: which affecting the body once, make no further impression upon it while they prevail in the neighbourhood, or exempt it indefinitely for the rest of life. Most of us must be aware how, during the last cholera epidemic, an attempt was made to make this theory applicable to the explanation of all the cholera phenomena, but with what little success or credit to medical philosophy it is needless here to tell. The chemical or fermentation theory of Professor Liebig has, however, greater claims to consideration, both from the celebrity of his name and its apparent applicability for explaining the phenomena which follow the influence of septic poisonous principles on the animal economy, when new chemical combinations take place in the blood, and a fresh fermenting prin-

ciple or contagious matter is generated. Professor Liebig said that decomposed products of the blood communicate their own state of decomposition to this fluid ; not in all states, as Liebig thought, but in one of *retrograde metamorphosis*, as Dr. Carpenter plausibly maintains. The experiments of Magendie had shown, that if a few drops of water, impregnated with putrid meat or fish, were introduced into the sanguiferous system of a dog, the animal became affected with fever, laid down, refused food, and vomited an immense quantity of black matter, characteristic of yellow fever ; and on another occasion, similar experiments produced petechiæ on the skin. Somewhat similar results have been obtained by Mr. Marshall and Dr. Josh. Meyer, by injecting into the veins of animals cholera blood, as well as cholera ejections and dejections. Further experiments are yet necessary for establishing the communicability of cholera to animals, while, as far as yet known, they tend to establish the justness of Professor Liebig's views, that the effect of indefinite and definite poisonous agents are simply chemical actions, possessing power to suspend or neutralize the progressive chemical or nutritive actions of the animal economy, which is ever in active and vital exercise by the increase of some excretory function to eliminate the poison and preserve the system, in a condition of normal molecular metamorphosis. In cases of Asiatic cholera, the rice-water fluid purging appears to be vicarious of the suspended excretory functions of both the kidneys and the liver ; and in the animals so experimented on, vomiting of a whitish fluid and purging of a highly offensive thin mass took place. After death, the intestinal patches

of Peyer were found injected, and many of the gland capsules were turgid and white, as in cases of human cholera.

Having thus endeavoured to arrive at some knowledge of the nature, increase, and decline of epidemic diseases, according to the antecedent predisposition of the people, the insalubrity of the soil and situation, and the natural unhealthiness of the climate and season, we should endeavour to prevent and limit the spread of such diseases by removing the conditions of their development, both within and without the body. The poisonous influence of decayed animal or vegetable food, undergoing a kind of putrefaction, is a fact well established by the observation of practical men; and is one that proved highly detrimental to our Indian troops in China, after a supply of bad food and rations from Calcutta. Epidemic dysentery of a most severe and fatal type, as described by Dr. Bryson in a paper read to this Society, was produced among the men, the only portion of the force that escaped being the Madras Artillery, who were supplied, as Colonel Sykes has stated, with better provisions from Madras.

It cannot be doubted that the pabulous blood fermentative matter, which predisposes individuals to attacks of epidemic disease, and gives potency to their exciting causes, may be produced by imperfect assimilation of unsuitable food even of wholesome quality. How much more must the *retrograde metamorphosis* of the blood, which favours the decomposing action of extrinsic septic principles, be perfected by a vitiated diet and unwholesome water, full of albuminous matter in a state of septic decomposition? Every one



learns from his own experience, that certain kinds of food are more digestible and contribute more to his nutrition than others; and the experienced medical observer has many opportunities of estimating the value of attention to diet in warding off ordinary as well as epidemic disease. He also knows that a systematic and judicious adaptation of it to particular conditions and temperaments may be employed with great advantage, and to even supersede the necessity of medicine. It is here that the pretension of *homœopathy* has its stronghold. Without honestly avowing that appropriate diet, moderation in eating, exercise, bathing, and pure air, can, under ordinary circumstances, increase excretion from the skin, lungs, and kidneys, and thus restore health to disordered functions, it deludes the minds of its victims in more serious cases, where nature requires assistance from *therapeutic* remedies.

Regarding the peculiar blood *predisposition* of individuals, communities, or races, which facilitates the production of epidemic cholera, nothing very definite has yet been ascertained by minute chemical experiment; though it may be generally stated, as laid down in my pathological summary of the disease, published in 1849, that it consists “of a diminution or altered quality of its fibrine and other normal ingredients, impairing its formative and vital power, caused by unhealthy assimilation and improper food, malarious influence, damp, ill-ventilated apartments, unhealthy exhalations from drains, and certain occult epidemic conditions of the atmosphere.” The report of the Parisian Royal Academy of Medicine on the plague, states that this disease is developed in Egypt under



almost like conditions: "habitation on alluvial or marshy soil near the river Nile; low, ill-ventilated, crowded dwellings; warm and moist atmosphere; the action of animal and vegetable matter in a state of putrefaction; unwholesome and insufficient food; great physical and moral distress." Cholera has, however, in opposition to the now usual geographical limits of plague and yellow fever, spread itself into all countries, however different may have been the modes of living and habits of the inhabitants. We may therefore presume that the peculiar predisposition, which gives currency to this disease, is more dependent on the topographical, local, and atmospheric conditions which beget it, than on food and water. The report of the French commissioner, sent to observe the course of cholera in Russia in 1848, says, that it appears to be propagated in two separate modes: 1st, in obedience to a force which impels it over vast tracts of country, in a certain and determinate direction; 2nd, in obedience to a subordinate law, which causes it to disperse over towns situated on its course, and to prevail in them for a greater or less space of time. The first law, or the relation of the usual phenomena to a general principle, appearing to be, that it spreads over wide tracts of country by migratory atmospheric influences, in the manner of other epidemics, and quite independently of the effect produced by the assembling together of infected persons, under those unsanitary conditions which favour the generation of secondary ochletic miasms from the human body.

Regarding the plague, Dr. Lachère found that the epidemic influence affected persons well isolated, so

as to destroy one individual in four hundred, while the contagious miasmata escaping from the bodies of the impested among the population in free pratique, killed one in every three. But in respect to cholera, though we have no valid evidence that intercourse between the sick and well, under ordinary circumstances, increases the disease, yet facts concerning it collected in India, rather tend to show that such is sometimes the case, though, as I have already said, it is exceptional. In the valuable, I might say philosophical, and interesting report from the Medical Board at Madras, on the health of the European and Native Troops of that Presidency for 1849, it is stated,—“At Trichinopoli, as in all other places, it has been observed that cholera is always most destructive in crowded and dirty localities, and about the cold season it usually makes its appearance among the crowded houses in the Fort, whence it spreads to the cantonment.” Again regarding the prevalence of the disease among the sepoys of the 5th regiment of Native Infantry, at Kurnool, it says,—“This disease first appeared in the Pettah of Kurnool, on the 29th April, having been introduced by a party of Brahman travellers from Bellary: one of the European officers was attacked on the 19th of May, and died on the 20th; 32 sepoys, generally in single cases, from the 7th of May, till the 3rd of August, with 18 deaths: and 141 followers applied for aid, of whom only 34 died; while of 15 other followers who did not apply, 11 fell victims. There is, therefore, strong presumptive evidence that, in obedience to the second law mentioned, it may, and more particularly in cold weather, spread according to the course of contagious

diseases, and like the typhus of cold countries. Mr. Russel and Mr. Orton at least, who had observed its generally not contagious character under the tropical heat of India, changed their opinion to the belief that it sometimes assumed the opposite character in Europe.

Since cholera and other epidemic diseases, then, may be potent for evil in proportion as the accessory circumstances which attend the attacks remain unchanged or unremoved, it is the duty of every wise and paternal government to prevent the market sale of improper articles of diet, or meat in a state of incipient decomposition, as well as to provide for the population houses of refuge, with a supply of good and untainted water ; to prevent dwellings for the poor being built in very damp and unhealthy localities, where they are surrounded by septic emanations from decomposing vegetable and animal matters ; to improve as much as possible the condition of those already built, by draining, ventilation, white-washing, and general cleanliness ; and as a wise precautionary measure to allow of no more intercourse between the sick and well than may be necessary for their comfort, nursing, and, proper medical treatment.

But in venturing thus far on the practical application of scientific rules for the prevention of general disease, to secure public health, I encroach on the important subject of Medical Police and general Hygiene, and though such has hitherto been little cultivated in England, I trust the time is not far distant when it will be systematized and taught in our schools as much as other departments. To the army medical officer, if not of greater, it is at least of equal

importance with other departments: and from ignorance of its principles, the valuable lives of our soldiers have been too frequently sacrificed abroad and on foreign stations.

And now, gentlemen, permit me to say in conclusion, that the Institution of this Society may be taken as a happy augury of what we may expect for the future advancement of Preventive Medicine, in relation to its utility, both for the civil and military institutions of this great country. Things on this head have hitherto been better managed on the continent: but, now that we are associated for carrying out a great public good, I trust the labours of this Society may be properly recognized by the public and the Government, as our object is not to benefit ourselves, but the many, who must profit by our researches.